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A Method for Estimating the Number of Spruce Budworm Eggs per Egg Mass¹

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The spruce budworm (*Choristoneura fumiferana* Clemens) has maintained an epidemic level in Minnesota since 1933. An intensive research program was initiated by the Lake States Forest Experiment Station, U.S. Forest Service, in 1958 to develop methods for controlling this pest. One of the problems encountered in this program was the estimation of egg deposition in the field.

In order to obtain a reliable estimate of egg parasitism, non-viability, and hatch, all egg-mass collections are taken after hatching has been completed. Viable eggs, before hatching, are easily distinguished in the egg mass and can be readily counted, but the boundaries of the translucent chorions of the hatched eggs are almost indistinguishable, making it extremely difficult to count the individual egg shells. Because of this, a study was undertaken to determine if the number of eggs per mass could be correlated with egg-mass length and/or width.

A sample of 33 unhatched egg masses from balsam fir in each of three different stand conditions was checked for the number of eggs per mass. As spruce budworm eggs are generally laid in 2- or 3-row masses, the data on eggs per mass were recorded for these two categories. These data were then subjected to a statistical analysis. The number of eggs per mass of given length varied similarly in each of the three conditions studied. A straight-line relationship was found between number of eggs and egg-mass length for egg masses of 3 mm. through 7 mm. in length. The extension of the regression line permitted the inclusion of data for egg-mass lengths for 8 mm. and for 8 mm. through 10 mm. Table I was developed from these data.

Further analysis of the raw data showed that egg-mass lengths ranged from 4 mm. to 10 mm., with approximately 61% equally distributed in the 4 mm. to 5 mm. range. The remainder was about equally distributed in the 6 mm. to 10 mm. range. This distribution pattern makes it undesirable to use an average number

Table I.—Estimated number of spruce budworm eggs per mass based on length of egg mass and number of rows of eggs²

Length of Egg Mass (mm.)	Two Rows of Eggs	Three Rows of Eggs
4	3.50	7.00
5	8.07	13.13
6	12.54	18.64
7	17.00	21.70
8	21.60	29.00
9	26.14	33.11
10	30.62	40.00
9	33.13	40.00
10	39.04	51.38

* The table can be used for egg masses collected either before or after hatching. Although the egg mass may contract somewhat in hatching, the original length is easily seen by marks left on the needle.

of eggs per mass for population studies.

This table was field tested the following year with 200 unhatched egg masses. A random set of 30 of these egg masses was subjected to a "t" test to determine if the average difference between estimated number, based on egg-mass length, and the actual number of eggs per mass was significant. This test led to the acceptance of the hypothesis that the mean difference between these two sets of numbers was equal to zero. Furthermore, these differences were not correlated with length of the egg mass.

In all our future studies of the spruce budworm in the Lake States, the number of spruce budworm eggs per egg mass will be estimated from length of egg mass as given in table I.

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